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Investigating the relationship between students' digital literacy and their attitude towards using ICT

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KEYWORDS

Use of ICT
Digital literacy
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ABSTRACT

This study aimed to explore the relationship between secondary school students' digital literacy and their attitude towards using information and communication technology in a private secondary school in Karachi, Pakistan. For this study, the data were collected through survey questionnaire using google forms. The total sample size for this study was 344 secondary school students having almost equal ratio of male and female. On bivariate correlation analysis, digital literacy was found to be associated with students' attitude towards using information and communication technology (ICT) and other ICT related demographics. Further analysis using multiple linear regression analysis showed that digital literacy (DL), use of the tablet and smartphone, prior training in the use of computer and frequency of computer use significantly affect students' attitude towards using ICT.

Introduction

With the emergence of educational technology, goals, objectives and processes of teaching and learning have been continuously changing. It seems that education is affected by technology, specifically ICT, which has undoubtedly affected teaching and learning processes. Many educational systems use ICT believing its use brings many benefits to students and empower teachers and learners in terms of enhancing their learning and acquiring 21st century skills. It is generally believed that ICT presents students with a new teaching and learning environment that is more collaborative and engaging. However, despite this rapid growth in use of ICT and technology, the use of digital technologies for learning has created challenges for schools and policy makers to incorporate new skills that become necessary in today's knowledge society. Even with the availability of quantity and quality of technology in schools and homes and easy access to technology, ICT skills, DL and the right attitude towards technology are the important factors to be known (Kadel, 2005).

Ferrari (2012) argue that "being digitally literate today involves the knowledge, attitudes and skills needed for operating technologies, using the internet, understanding the media and managing information. However, the convergence of literacies into the digital is, however, more than the sum of its single elements" (p.16). Research studies (Liaw & Huang, 2011; Rhema & Miliszewska, 2014) have shown that a student's skill in technologies is a significant predictor of attitudes towards ICT. This attitude may influence the students' perceived and actual DL and ICT skills. Better ICT skills are seen to have a positive impact on students' motivations and attitude. Research studies indicate that a better DL enhances positive attitude towards technology (Abdullah, Ziden, Aman, & Mustafa, 2015; Hussain, 2007; Nassoura, 2012). In reverse, Boser, Palmer and Daugherty (1998) conducted an experimental study and found that the change in attitude points to increased level of DL; the more positive attitude, the better DL. Likewise, research studies (Sad & Ozhan, 2012;

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Qing, 2007) show that students possess a favourable attitude towards the use of ICT as it helps in finding reliable information and visualizing abstract ideas. It seems that there exists a relationship between DL and students' attitude towards using ICT. OECD (2012) considers the association between the use of ICT and DL as a pre-requisite of the digital world.

There are research studies which state that the relationship between attitude and DL is affected by demographic factors. For instance, research studies (Motshegwe & Batane, 2015; Seyal, Rahim & Rahman, 2002) have associated students' attitude and their ICT skills with computer ownership. They believe that students having personal computers are more likely to have a positive attitude towards using ICT. Likewise, Hargittai (2005) claims that time spent on computers at home and frequency of computer usage have a positive relationship with the DL and attitude. Besides computer ownership and usage, hand held devices such as smartphones and tablets appear to influence students' attitude towards using ICT. As an inexpensive and accessible device, smartphones and tablets might be appropriate technological devices to enhance DL and attitude. However, Gikas and Grant (2013) have reservations in associating the use of smartphones or tablets with DL because of limited effectiveness of smartphones in teaching and learning processes. However, Hatch (2011) asserts that students who spend more time using tablets and smart phones are likely to have positive attitude towards technology. It is believed that students spending more time using these devices are more likely to have better DL and positive attitude as compared to those who do not spend time on these devices. Hence, it can be assumed that technological devices can develop attitude and the DL of students.

Research studies (Klomsri & Tedre, 2016) assert that there is a significant association between attitude and students' access to internet at home. Having internet at home facilitates the practice of information literacy skills which boosts students' attitude towards using ICT. Moreover, school related factors such as the existence of computers in schools, teachers' competency and efforts and frequency of use of ICT in teaching and learning are seen as important predictors of attitude and the DL. Hatlevik and Christophersen (2013) explain that the way students attain DL is connected to systematic aspects, and characteristics of the students at individual level, rather than factors at the school level.

There are heterogeneous findings regarding students' attitude towards using ICT and its relationship with general demographic features such as gender, age, and proficiency in English. Regarding gender differences in attitude research studies (Hussain, 2011; Lee, Kim & Lee, 2015; Teo, 2006) found no difference in attitudes of males and females towards using ICT. However, research studies (Alzaza & Yaakub, 2012; Houtz & Gupta, 2001) associate attitude towards using ICT with gender.

Although, age is not considered as an important factor in determining attitude towards using ICT there are some studies that explore the relation between age and attitude towards using ICT. For instance, research studies (Attuquayefio & Addo, 2016; Selwyn, 2008) have reported that there is no association between the age of students and their attitudes towards computers. On the contrary, Kubiato (2010) found significant association between attitude towards using ICT and students in different years of study. It is reported that younger students have a more positive attitude and are more likely to have a better ICT skill than older students whereas Bozionelos (2001) has reported the opposite. This may be attributed to the fact that the younger generations are more into technology and are more skillful in using technology.

Likewise, students' expertise in English is found to be correlated with attitude as language of computer is English. Students having proficiency in English are seen to have a positive attitude as compared to students who struggle with English. Hepworth and Walton (2013) confirm that students with a low level of English proficiency are likely to face challenges in acquiring DL and fostering a positive attitude towards using ICT in teaching and learning. In this regard, Lwoga (2014) emphasises developing English language skills of the students, as all the computer skills are underpinned by proficiency in the English language.

To sum up, a review of the existing literature in the area of student attitude and digital literacy shows that students hold a positive attitude towards using ICT and have different levels of digital literacy. Many research studies have associated attitude with DL. However, there are a number of factors such as age, gender, proficiency in English, training in using computers, access to the internet, usage of hand-held technological devices and level of computer skills among others that seem to shape students' attitude and DL. Moreover, these factors appear to influence the relationship between attitude towards using ICT and DL.

Research Methods

For this study, a descriptive quantitative research design was used with the aim to identify and describe the current attitudes and existing relationships between the variables (Punch, 1998). A self-completion computer-based questionnaire was administered to secondary school students (n=344) in a private secondary school system. The questionnaire consisted of three sections. The first section sought information related to the participants' demographic characteristics, such as age, gender, class and experience of using technology, to determine and analyze factors that could influence students' attitude and DL skills. The second section of the questionnaire was adapted from Edmunds, Thorpe, and Conole (2012) that sought to find the attitude towards using ICT. The third section of the questionnaire was adapted from an online European Commission DL (ECDL) survey.

Through purposive sampling, this research was carried out in a private school system in Karachi, Pakistan. This school system was selected because the school has been using ICT for teaching and learning purposes for almost ten years. Moreover, the system has made investments in enabling students to be

computer literate. Hence, there is an assumption that with a similar level of exposure and experience of using technology in school, the differences in the ICT attitude and capabilities could be related to their DL skills and demographic data.

Students, both male and female, of grade 9 and 10, ages 13-16 years, were selected through simple random sampling. The reason for selecting grade 9 and 10 students was that they are the first cohorts of students who use ICT from class one onwards in the context of this school. Hence, they have maximum experience (9 to 10 years) using technology as compared to other classes within the same educational system. Besides, the assumption here is that these students are a young technology savvy generation exposed to a number of digital devices in and outside the educational context. Also, secondary level education is one of the essential pillars on which the education of students is grounded. The sample size for the study was (n=344) representing 40.85% students of the entire population (N=842).

Results

To determine students' attitude towards using ICT, an analysis of responses to the survey was conducted using SPSS 2.0. Considering 'strongly agree' and 'agree' with statements as indicators of positive attitudes, it was apparent that the majority of the respondents (53.48 %) had positive attitude towards using ICT in education.

In order to present students' overall performance on DL test, the percentages of mean scores were calculated for the whole sample. Results show that a large majority of students got more than 50% marks. This result indicates that a high number of students possess good DL. They have the ability to access, interpret and communicate through the ICT. One of the possible reasons for their expertise in DL could be due to their interest in ICT and training they receive at school.

Correlation between digital literacy, other independent variables and students' attitude towards using ICT

The association between student attitudes towards the ICT was checked against independent variables; DL, general demographic characteristics (school, class, gender, age, spoken at home, and proficiency in written English) and ICT related demographics (access to internet at home, having computer/laptop at home, frequency of computer/laptop use at home, purpose of using computer at home, having personal tablet/smartphone, frequency of use of tablet or a smartphone at home, frequency of computer use at school, purpose of computer use at school, number of years using ICT, level of computer skills and training in computer use). In order to find the association between dependent and independent variables, Spearman correlation coefficients were used. A detailed correlation matrix of Spearman correlation is presented in table 1.

Table 1: Bivariate correlation matrix

Independent variables	Mean of Attitude	
	Correlation Coefficient	Sig.
Level of DL	0.109*	0.043
Class studying in	0.104	0.054
Gender	0.045	0.408
Age of the participant	0.053	0.322
Language spoken at home	0.042	0.434
Proficiency in English (Written)	-0.105	0.053
Access to the Internet at home	-0.107*	0.046
Computer/laptop at home	-0.088	0.103
Frequency of computer/laptop use at home	-0.097	0.073
Purpose of using computer /laptop at home	0.074	0.168
Personal tablet or a smartphone at home	-0.049	0.366
Frequency of tablet/smartphone use at home	-0.031	0.572
Purpose of using tablet/smartphone	0.129*	0.016
Frequency of computer use at school	-0.126*	0.019
Purpose of using computer at school	-0.021	0.703
Number of years using (ICT) in education	0.140**	0.010
Prior training in use of computer	-0.158**	0.003
Computer skill level	-0.155**	0.004

*correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at 0.01 level (2- tailed)

Results show that students' attitude towards using ICT was found to be positively associated with DL ($r = 0.109$; $p < 0.05$), purpose of using tablet/smartphone ($r = 0.129$; $p < 0.05$), number of years using the ICT for educational purposes ($r = 0.140$, $p < 0.01$). However, students' attitude towards using the ICT was found to be negatively associated with access to the internet at home ($r = -0.107$; $p < 0.05$), frequency of computer usage at school ($r = -0.126$; $p < 0.05$), level of computer skill ($r = -0.155$; $p < 0.01$) and training in use of computer ($r = -0.158$; $p < 0.01$). This means DL, purpose of using tablet/smartphone, number of years using the ICT for educational purposes have positive effects on students' attitude towards using the ICT. However, access to the internet at home, frequency of computer usage at school, level of computer skill and prior training of computer operations are negatively associated with attitude. This shows that they have reverse effects on students' attitude towards the ICT. Surprisingly, all other demographics characteristics (school, gender, class, age, language spoken at home, and proficiency in written English) were found not to be associated with students' attitude towards using ICT.

Based on these associations multiple regression model was developed using mean scores to predict the magnitude and influence of each of these variables to the total variance explained in the prediction of attitude towards using ICT.

Multiple linear regression analysis

The predictive factors concerning students' attitude towards using ICT was investigated using regression analysis. In this study, total mean score of attitudes towards using ICT was used as dependent or outcome variable. Level of DL, purpose of using tablet/ smartphone, number of years using ICT for educational purposes, access to the internet at home, frequency of computer usage at school, level of computer skill and training in use of computer were considered as independent variables or predictive variables. These predictive variables showed a significant association with attitude in bivariate correlation; therefore, these were included in the multiple regression model.

In bivariate correlation, seven variables showed an association with overall attitude. However, in multiple regression model, only four variables showed significant association with outcome variable. Before executing multiple regression, variables which were not dichotomous were changed into dummy variables. Variables were included in the model in their order of importance described in literature. As, Field (2009) suggests that, "when there is a sound theoretical literature available, then base your model upon what past research tells you. Include any meaningful variables in the model in their order of importance" (p.260). Initially, level of DL was added to the model followed by level of computer skills, frequency of computer use, training in use of computer, number of years using ICT for educational purposes, access to the internet at home and usage of tablet/smartphone. Table 2 presents the model of multiple linear regression.

Table 2: Multiple regression model explaining the standardized beta values

	B	Beta	t	sig	r
(Constant)	3.72	-----	18.66	0.000	-----
Digital Literacy	0.05	0.13	2.39	0.017*	0.110
Use of tablet / smart phone; never vs work/study	0.17	0.15	2.85	0.005**	0.129
Training in use of computer	-0.16	-0.14	-2.70	0.007**	-0.158
Frequency of computer use at school	-0.28	-0.12	-2.24	0.026*	-0.126

*correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at 0.01 level (2- tailed)

The analysis presented in table 6 shows that the standardized beta value for variable 'DL' is positive and significant ($\beta = 0.13$, $p = 0.01$). This indicates that students who scored higher on DL demonstrated more positive attitude to use ICT as compared to the students who scored low on DL. Similarly, the variable 'use of tablet or smart phone' was found to have positive significant effect ($\beta = 0.15$; $p = 0.00$) on attitude towards using ICT. This tells us the use of tablet or smartphone for work and study has an impact on attitude towards using ICT. This variable is found to be the strongest predictor of the attitude towards ICT in this model. On the other hand, analysis show that the standardized beta value for variable 'training in use of computer' is significant and negative ($\beta = -0.14$; $p = 0.00$). The negative coefficient for prior training explains that students without prior training showed more positive attitude towards using ICT as compared to those students who have some prior training outside the school. Similarly, the negative beta value for frequency of

computer use at school ($\beta = -0.12$; $p = 0.02$) tells us that students who do not use computer frequently at school have more positive attitude towards using ICT. Nevertheless, this variable shows the least effect on students' attitude towards use of ICT among other independent variables in the model.

In addition to standardized beta values, the beta weight (B), t-ratio values and significance level for each independent variable contribute to the prediction of the attitude towards using ICT. However, the magnitude of the contribution is very small.

Furthermore, the result of the regression analysis on the relationship between students' attitude towards using ICT with the four independent variables gives statistically significant coefficient of multiple correlations square R^2 of 0.082. In overall attitude model, the value of R^2 is 0.082, which explains 8.2 % of the variance in the mean attitude. This indicates that only 8.2% of the variance explained with regard to the attitude towards using ICT was explained by the combination of the four independent variables. This means that 91.8% of the variability is still to be accounted for by other variables. In other words, if the model were derived from the population rather than a sample it would account for approximately 8.2 % less variance in the outcome. Moreover, the F test shows the model has a significant linear relationship [$F(4,339) = 7.53$, $p = 0.000$]. The relationship among these two variables is statistically significant. This means that the chance that the results of the regression are by real relationship not by random.

It can be concluded that little amount of the variance in attitude is explained through this research. However, considering the significance level ($p < 0.05$), it can be established that there is an impact of DL on students' attitude towards using ICT. Yet, the model and impact of DL on attitude is weak. Moreover, prior training in computer use, use of tablets or smart phones and frequency of computer use at school has a significant effect on students' attitude towards using ICT. Interestingly, the variable 'using tablet or smart phone for work or study' has the most effect on the students' attitude towards use of ICT among other independent variables.

Discussion

In general, the study shows that students have positive attitude towards using ICT and have adequate level of DL. Multiple regression analysis shows that, the DL was found to be associated with students' attitude towards using the ICT. This shows that there is a relationship between students' attitude towards using the ICT and their level of the DL.

Results on bivariate correlation reveal that student's ICT related demographics; access to the internet at home, number of years using ICT for educational purposes, level of computer skills, use of tablet or smartphone, prior training of running computer, frequency of computer usage and DL show a significant association with students' attitude towards ICT.

Prior research studies (e Rhema, & Miliszewska, 2014) reveal that accessibility of technology affects students' attitudes and correlates positively with the level of technology use. Umer and Jalil (2012) are of the opinion that the internet facility contributes towards developing eagerness and abilities in using computer. Usually, accessibility to the internet at home is taken for leisure time activities, playing games or using social media. Students' use of internet regardless of activities they do, seem to develop positive attitude towards using ICT. However, in the context of this study, access to the internet at home was found to be negatively associated with students' attitude towards using ICT.

Similarly, number of years students use ICT is negatively correlated with the attitude. This tells us that student who have been using ICT for less number of years have more positive attitude as compared to others. This finding is in line with findings of Paris (2004) that claimed that computer experience does not help people develop positive computer attitudes. It might be due to the advancements and innovations in ICT devices. Technological advances require new skills and procedures on the part of teachers and students, so it can be expected that students attitude vary from device to device and year to year. However, this finding negates the findings of Hargittai (2005) that showed that students' previous experience with computer is significantly associated with attitude.

Regarding the level of computer skills, research studies (Karim, 2009; Liaw & Huang, 2011; Rhema, & Miliszewska, 2014) reveal that students' and teachers' skills in using computer and other technologies are a significant predictor of their attitudes towards ICT. Usually, it is considered that higher level of computer skills stimulates a positive attitude and lower level of computer skills limit students' acceptance of technology. However, in the context of this study it was otherwise. In this study, computer skill is found to be negatively associated with attitude showing that students having moderate level of skills have more positive attitude and vice versa. It might be due to current students' priorities. Current generation of students is more persuaded by other technological devices particularly mobile phones, tablets and laptops than computers. Since, majority of students own personal smartphones and tablets so skills in using these devices are more likely to influence their attitudes rather than computer skills. It seems that students' interaction with mobile phones particularly touch screen interface attracts their curiosity and willingness to use ICT in education. Research studies (e.g.Park, 2009) point out that students attitude towards ICT are influenced by number of external variables which can be related to context, exposure to technology and era in

which study is conducted. Since, the participants of this study are technologically savvy and inspired by latest technological inventions particularly smartphones, so they are more likely to be inspired by use of smartphones and tablets rather than computers.

However, general demographics, such as age, gender and proficiency in English were found not to be associated with attitude. In general, these demographic characteristics did not seem to have any relationship with overall attitude towards using the ICT. However, in other studies there are heterogeneous findings regarding association between general demographics and attitude towards the ICT. For instance, research studies (Eshet-Alkalai & Hamburger, 2004; Kubiak, 2010) found a significant correlation between age and attitude towards using the ICT. Likewise, Rahimi and Yadollahi (2011) correlate language with attitude towards using ICT. But in terms of gender (Attuquayefio & Addo, 2016; Selwyn, 2008) revealed no correlation between gender and the ICT attitude.

Furthermore, the results of multiple regression model confirm that DL is positively associated with students' attitude towards using ICT. This means students level of DL influence their attitude towards using the ICT. It can be assumed that students having good DL skills are more likely to have positive attitude towards using ICT in education as compared to students who do not have good level of DL skills. Along with DL, three other variables - use of tablet/smartphone, prior training in computer and frequency of computer use - show statistically significant effect on students' attitude towards using ICT on multiple regression model. 'Use of tablet and smartphone for work and study' shows the highest effect on the students' attitude towards ICT. Use of smartphone or tablet is found to be positively correlated with attitude and showed more impact on attitude as compared to other variables. These findings are in line with (Gikas & Grant, 2013; Ismail, Bokhare, Azizan & Azman, 2013) who believe that the current generation of students is highly motivated to use mobile phones in educational settings. Hence, it can be assumed that students who use tablets or smartphones exhibited more positive attitudes towards the use of ICT as compared to the students who do not use tablets or smart phones. One of the possible reasons could be students who own technological devices particularly; tablets and smart phones have more interaction with these devices resulting in enhancing their positive attitude towards technology. Other reasons could be students' inspiration and acceptance of touch screen technology.

Surprisingly, students' prior training (outside of school) in the use of computer is negatively correlated with attitude. It can be established that students who received any training outside of school through any external resources in using computer may not essentially develop their positive attitude towards using ICT. In the context of this study, training attained outside of school does not contribute in developing a positive attitude towards using ICT in education. This finding is consistent with Klomsri and Tedre (2016) who found that students without any ICT training are more likely to have a positive attitude than students with training. Students having no prior training seem to have a more positive attitude and vice versa. The reasons could be ineffectiveness of trainings or inappropriate time and content. Hence, it can be assumed that trainings in using computer may not necessarily contribute in developing a positive attitude towards using ICT. However, Karim (2009) found that computer training has a significant role in developing attitude. Students use technology at various places, such as the home, school and library. The frequency and duration of technology usage, particularly in school, seems to be an important indicator of technology acceptance. Akturk, Izci, Caliskan and Sahin (2015) reported that attitudes towards technology depend on the frequency of interactions with technological devices at home or at school. Students spending more time using computer are more likely to have a positive attitude as compared to those who do not spend time on the computer. However, in this study the frequency of computer usage at school was found to be negatively associated with attitude. This shows that students who spend more time on computers have a less positive attitude towards using ICT. One of the possible reasons could be that these students feel bored of using desktop computers. Since, they are experiencing and exploring touch screen technology, so they may have a more positive attitude towards using tablets, smartphones and other related devices.

Conclusion

This study provides a baseline to plan and design ICT and DL programs for students and teachers in the context of developing countries like Pakistan. Further opportunities seem to exist to explore assessment frameworks for DL. Mostly studies related to the DL have been conducted mainly in countries having higher levels of the ICT integration and ICT resources. In order to properly inform education policy makers in developing world context, research studies are needed to be conducted in the context where ICT is integrated at low to moderate level. Moreover, such studies are needed to be conducted at primary level where students are more likely to have low level of experience with the ICT. Such contextual studies will not only inform policy makers about students DL but also present wide range of DL skills in low to moderate level of technological contexts. Furthermore, it is important to consider the role of emerging gadgets such as laptops, smartphones and tablets in shaping students' attitude and developing their digital literacies. UNESCO Global Education Monitoring Report (2016) insists on understanding and exploring the set of competencies that are required to measure digital literacy applied in latest technologies and social media context.

Based on this study, it can be concluded that there is a relationship between students' DL and their attitude towards using the ICT. However, there are other ICT and technology related factors that shape and influence students' attitude. In this study, DL, use of tablets and smart phones, training in use of computer and the number of years using ICT are found to have a significant correlation with attitude showing that they influence attitude. Among these four variables, the use of tablets and smart phones is found to have more impact on attitude as compared to others. Although all these variables influence students' attitude, their impact on attitude is weak. Since, the impact and amount of variance explained is very weak therefore, the contribution of other ICT related factors are needed to be explored.

It is important to note that the findings in different studies revealed inconclusive results in regard to the relationship between attitudes toward using the ICT and demographic characteristics. Some studies revealed a significant correlation between attitudes towards ICT and demographics, but others revealed no significant correlations. It is hoped that this study would shed some light in exploring relationship between different factors with attitude in context of Pakistan.

REFERENCES

- Abdullah, Z. D., Ziden, A. B. A., Aman, R. B. C., & Mustafa, K. I. (2015). Students' attitudes towards information technology and the relationship with their academic achievement. *Contemporary Educational Technology*, 6 (4), 338-354. Retrieved April 15, 2017 from <http://www.cedtech.net/articles/64/645.pd=ed>
- Akturk, O. A., Izci, K., Caliskan, G., & Sahin, I. (2015). Analyzing preservice teachers' attitudes towards technology. *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering* 9, (12), 4279-4282. Retrieved December 18, 2016 from <http://files.eric.ed.gov/fulltext/ED563253.pdf>
- Attuquayefio, N. S., & Addo, H. (2016). Gender and age comparison of information communication and technology usage among Ghanaian higher education students. *American Journal of Information Systems*, 4(1), 1-6. doi: 10.12691/ajis-4-1-1
- Alzaza, S. N., Yaakub, A. (2012). Students' awareness and requirements of mobile learning services in the higher education environment. *American Journal of Economics and Business Administration*, 3(1), 95-100. doi : 10.3844/ajebasp.2011.95.100
- Boser, R. A., Palmer, J. D., & Daugherty, M. K. (1998). Students' attitudes toward technology in selected technology education programs. *Journal of Technology Education*, 10(1), 4-18. doi: <https://doi.org/10.21061/jte.v10i1.a.1>
- Bozionelos, N. (2001). Computer anxiety: relationship with computer experience and prevalence. *Computer in Human Behavior*, 17(2), 213-224. doi: [https://doi.org/10.1016/S0747-5632\(00\)00039-X](https://doi.org/10.1016/S0747-5632(00)00039-X)
- Edmunds, R., Thorpe, M., & Conole, G. (2012). Student attitudes towards and use of ICT in course study, work and social activity: A technology acceptance model approach. *British Journal of Educational Technology*. 43 (1), 71-84. doi:10.1111/j.1467-8535.2010.01142.x
- Eshet-Alkalai, Y., & Hamburger, A.Y. (2004). Experiments in digital literacy. *Cyber Psychology & Behavior*, 7(4), 421-429. Retrieved November 21, 2016 from <https://pdfs.semanticscholar.org/ce06/4a8f618a575e32e683c161a60f7a56c9acdd.pdf>
- Ferrari, A. (2012). *Digital Competence in practice: An analysis of frameworks*. Seville: JRC-IPTS. Retrieved September 16, 2016 from <http://ftp.jrc.es/EURdoc/JRC68116.pdf>
- Field, A. P. (2009). *Discovering Statistics using SPSS*. (Third ed.). England, London: SAGE Publications.
- Gikas, J., & Grant, M. M. (2013). Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones & social media. *The Internet and Higher Education*, 19, 18-26. Retrieved May 6, 2017 from https://www.researchgate.net/publication/312136352_Dimensions_affecting_student_participation_in_online_discussion_forums_A_review_of_literature_and_a_current_investigation
- Hatch, E. K. (2011). Determining the Effects of Technology on Children. Senior Honors Projects. Paper 260. Retrieved May 20, 2017 from <http://digitalcommons.uri.edu/srhonorsprog/260http://digitalcommons.uri.edu/srhonorsprog/260>
- Hussain, I. (2007). A study of student's attitude towards virtual education in Pakistan. *Turkish Journal of Distance Learning*, 8(2), 69-79. Retrieved September 12, 2016 from http://tojde.anadolu.edu.tr/tojde26/pdf/article_6.pdf
- Hatlevik, O. E., & Christophersen, K. A. (2013). Digital competence at the beginning of upper secondary school: Identifying factors explaining digital inclusion. *Computers & Education*, 63, 240-247. doi: <https://doi.org/10.1016/j.compedu.2012.11.015>
- Hepworth, M., & Walton, G. (Eds.). (2013). *Developing people's information capabilities: fostering information literacy in educational, workplace and*

community contexts. Emerald Group Publishing.

Houtz, L. E., & Gupta, U. G. (2001). Nebraska high school students' computer skills and attitudes. *Journal of Research on Computing in Education*, 33(3), 316-326. doi: <http://dx.doi.org/10.1080/08886504.2001.10782317>

Hargittai, E. (2005). Survey measures of web-oriented digital literacy. *Social Science Computer Review*, 23(3), 371-379. doi: 10.1177/0894439305275911

Ismail, I., Azizan, S. N., & Azman, N. (2013). Mobile phone as pedagogical tools: Are teachers ready?. *International Education Studies*, 6 (3), 36–47. doi: <https://doi.org/10.5539/ies.v6n3p36>

Kadel, R. (2005). How teacher attitudes affect technology. *Learning and Leading with Technology*, 39 (5), 34-47. Retrieved September 7, 2016 from <http://files.eric.ed.gov/fulltext/EJ697309.pdf>

Klomsri, T., & Tedre, M. (2016). Poor information literacy skills and practices as barriers to academic performance: A mixed methods study of the University of Dar es Salaam. *Reference & User Services Quarterly*, 55(4), 293-305. Retrieved April 6, 2017 from <https://journals.ala.org/index.php/rusq/article/view/6004>

Karim, D. (2009). *Exploring the attitude of the head and deputy head teachers from the governments schools of Sindh and Balochistan toward using computers in education(Unpublished master's dissertation)*. Aga Khan University, Karachi, Pakistan.

Kubiato, M. (2010). Czech university students' attitudes towards ICT used in science education, *Journal of Technology and Information Education*, 2(3), 20-25. Retrieved December 10, 2016 from http://www.kubiato.eu/clanky_pdf/czech_university_students_attitudes_towards_ict_used_in_science_education.pdf

Lee, S., Kim, J., & Lee, W.(2015). Analysis of elementary students' ICT literacy and their self-evaluation according to their residential environments. *Indian Journal of Science and Technology*, 8(1), 81-88. doi: 10.17485/ijst/2015/v8iS1/57595

Liaw, S. S., & Huang, H. M. (2011). A study of investigating learners attitudes toward e-learning. In *2011 5th International Conference on Distance Learning and Education* (Vol. 12, pp. 28-32). May 10, 2017 from <https://pdfs.semanticscholar.org/798b/880bb4e1a5a2dadcea73f828178bf28cf313.pdf>

Lwoga E. T. (2014). Critical success factors for adoption of web-based learning management systems in Tanzania. *International Journal of Education and Development Using ICT*, 10 (1), 4-21.

Motshegwe, M. M., & Batane, T. (2015). Factors influencing instructors' attitudes toward technology integration. *Journal of Educational Technology Development and Exchange (JETDE)*, 8(1), 1-15. doi: 10.18785/jetde.0801.01

Nassoura, A. B. (2012). Students' acceptance of mobile learning for higher education in Saudi Arabia. *American Academic & Scholarly Research Journal*, 4(2), 24-30. Retrieved April 23, 2016 from <https://pdfs.semanticscholar.org/37a5/c952e6e0e3d6d7cd5c30cf4307ee06e4ab5c.pdf>

OECD (2012). Innovation for development a discussion of the issues and an overview of work of the OECD directorate for science, technology and industry. Retrieved September 4, 2016 from <http://www.oecd.org/innovation/inno/50586251.pdf>

Paris, P. G. (2004). E-learning: A study on secondary students' attitudes towards online web assisted learning. *International Education Journal*, 5(1), 98-112. Retrieved October 11, 2016 from <http://ehlt.flinders.edu.au/education/iej/articles/v5n1/paris/paper.pdf>

Park, S. Y. (2009). An Analysis of the technology acceptance model in understanding university students' behavioral intention to use e-Learning. *Educational Technology and Society*, 12(3), 150–162. doi: <http://dx.doi.org/10.1007/s00340-009-3513-0>.

Punch, K. F. (1998). *Introduction to Social Research: Quantitative and Qualitative Approaches* (1st ed.). London, Thousand Oaks California, New Delhi: SAGE Publications.

Qing, L. (2007). Student and teacher views about technology: A tale of two cities? *Journal of Research on Technology in Education*, 39(4), 377-397. Retrieved May 28, 2016 from <http://files.eric.ed.gov/fulltext/EJ768884.pdf>

Rahimi, M., & Yadollahi, S. (2011). Computer anxiety and ICT integration in English classes among Iranian EFL teachers . *Procedia Computer Science* 3, 203–209. doi:10.1016/j.procs.2010.12.034

Rhema, A., & Miliszewska, I. (2014). Analysis of student attitudes towards e-learning: The case of engineering students in Libya. *Issues in Informing Science and Information Technology*, 11, 169-190. Retrieved September 13, 2016 from <http://iisit.org/Vol11/IISITv11p169-190Rhema0471.pdf>

Şad, S., & Özhan, U. (2012). Honeymoon with IWBs: A qualitative insight in primary students' views on instruction with interactive whiteboard. *Computers & Education*, 59(4), 1184-1191. doi:10.1016/j.compedu.2012.05.010

Selwyn, N. (2008). An investigation of differences in undergraduates' academic use of the internet. *Active Learning in Higher Education*, 9(1), 11-22. doi: doi/pdf/10.1177/1469787407086744

Seyal, A. H., Rahman, M. N., & Rahman, M. M. (2002). Determinants of academic use of the internet: A structural equation model. *Behaviour and Information Technology*, 21(1), 71-96. doi: <http://dx.doi.org/10.1080/01449290210123354>

Teo, T. (2006). Attitudes toward computers: A study of post-secondary students in Singapore. *Interactive Learning Environments*, 14(1), 17-24. doi: <http://dx.doi.org/10.1080/10494820600616406>

Umar, I. N., & Jalil, N. A. (2012). ICT skills, practices and barriers of its use among secondary school students. *Procedia - Social and Behavioral Sciences*, 46, 5672 – 5676. doi:10.1016/j.sbspro.2012.06.494

UNESCO (2016). Global Education Monitoring Report. Retrieved May 23, 2017 from <http://unesdoc.unesco.org/images/0024/002459/245918E.pdf>